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- 1445 *Trifolium globosum repens* C. B. P. 329
 1446 *Tordylium maximum* Inst. R. H. 320.
 1447 *Tragofelinum maximum Austriacum foliis magis incisfis* Boer.
 1448 *Valeriana Lusitanica latifolia annua laciniata* Tourn. 132.
 1449 *Verbena tenuifolia* C. B.
 1450 *Urtica racemifera maxima Sinarum foliis subtus argentea lanugine villosis.* Pluk. Almag. 212.
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XXV. *Some Observations upon the Sex of Flowers by W. Watson, F. R. S. occasioned by a Letter upon the same Subject, by Mr. Mylius of Berlin.*

Extract of Mr. Mylius's Letter to Mr. Watson, dated at Berlin, Feb. 20, 1750-51.

Read May 2. 1751. “ **T**HE sex of plants is very well confirmed by an experiment, “ that has been made here on the *palma major foliis flabelliformibus*. There is a great tree of this “ kind in the garden of the royal academy. It has “ flower’d and bore fruit these thirty years; but the “ fruit never ripen’d; and when planted, it did not “ vegetate. The palm-tree, as you know, is a *planta dioecia*; that is, one of those, in which the male “ and female parts of generation are upon different “ plants. We having therefore no male plant, the
 Y “ flowers

“ flowers of our female were never impregnated by
 “ the *farina* of the male. There is a male plant of
 “ this kind in a garden at Leipfic, twenty German
 “ miles from Berlin. We procured from thence in
 “ April 1749 a branch of male flowers, and sus-
 “ pended it over our female ones; and our experi-
 “ ment succeeded so well, that our palm-tree pro-
 “ duced more than an hundred perfectly ripe fruit;
 “ from which we have already eleven young palm-
 “ trees. This experiment was repeated last year,
 “ and our palm-tree bore above two thousand ripe
 “ fruit. As I do not remember a like experiment,
 “ I thought convenient to mention it to you; and;
 “ if you think proper, be pleased to communicate
 “ it to the Royal Society.”

In pursuance of my correspondent's desire, I take the liberty of laying this account before you, which I think very curious; not on account of its novelty, or of its confirming the sex of plants, which is now sufficiently established; but on account of the male and female palm-tree's flourishing so completely, even under all possible advantages, in such high latitudes as those of Leipfic and Berlin.

The impregnation of the female palm-tree by the male has been known in the most antient times. Herodotus *, whom Cicero calls the father of history, when

* Herodot. Κλειώ.

Τὰ τε ἄλλα καὶ φοινίκων τὰς ἑρσενεὺς Ἕλληνες καλῶσι, τῶν τὸν καρπὸν περιδύουσι τῇσι θαλασσιπλοοῦσι τῶν φοινίκων, ἵνα πεπαίνῃται σφὶ ψὴν τὴν βάλανον ἐσθύνων, καὶ μὴ ἀπορρέῃ ὁ καρπὸς ὁ τῶν φοινίκων. Ἥτινα γὰρ δὲ φέρεται ἐν τῷ καρπῷ οἱ ἑρσενεὺς, καθάπερ δὴ οἱ ὀλυνδαί.

when speaking of the palm-tree, says, " that the
 " Greeks call some of these trees male, the fruit of
 " which they bind to the other kind, which bears
 " dates ; that the small flies, wherewith the male
 " abounds, may assist in ripening the fruit ; for, says
 " this author, the male palm-tree produces in its
 " fruit small flies, just as the fig-tree does." The very
 remote age, in which Herodotus wrote, sufficiently
 apologizes for his believing, that what was really
 brought about by the *farina fœcundans* of the male
 flower, was to be attributed to the insects frequently
 found therein, and which perhaps very often do carry
 this *farina* from the male to the female. They had
 seen the effects of caprification in fig-trees by these
 insects, and were misled by the analogy. I have here
 translated them small flies, but they had a particular
 appellation given them by Herodotus, Aristotle *,
 and Theophrastus, who call them ψύλλ. Pliny, in
 his history, when treating of caprification, which is
 almost a translation from Theophrastus, calls them
culices, Linnæus *ichneumones*, and Tournefort *mou-*
cherons.

Theophrastus §, the most early writer of plants,
 except Aristotle, that has been handed down to us,
 in his account of the palm-tree gives us the very
 process mentioned by our correspondent. " They
 " bring together (says this author) the males and
 " the females, which causes the fruit to continue,
 " and ripen upon the trees. Some, from the simili-

Y 2

" tude

* Aristoteles περὶ ζώων. Οἱ δὲ ἱρῖνοι . . . ἔχουσι ὥς καλυμένους
 ψύλλας.

§ Theoph. περὶ φυτῶν. Κεφ. θ.

“ tude of this to what happens in fig-trees, call it
 “ caprification ; and it is performed in the following
 “ manner : While the male plant is in flower, they
 “ cut off a branch of these flowers, and scatter the
 “ dust and down therein upon the flowers of the
 “ female plant. By these means,” he goes on, “ the
 “ female does not cast her fruit, but preserves them
 “ to maturity.” Pliny* also mentions the like pro-
 cesses.

Among more modern authors, Prosper Alpinus † gives us at large the manner of the impregnation of the female palm-tree by the male, for the purposes before-mentioned. We have also copious accounts of the same process by Tournefort §, Kämpfer ||, and Ludwig **. As Kämpfer was an eye-witness, his account of this matter is most to be depended upon. He says, “ Plena res dignissimaque admirationis est
 “ modus palmas fœmininas fœcundandi. Habet id
 “ tot popularium, Persidis, Arabiæ, Ægypti, nutrix
 “ inter plantas singulare, ut animalium exemplo,
 “ mari statim tempore miscenda, atque singuli ejus
 “ uteri, quasi conjugali coitu, impregnandi sint ; se-
 “ cus omnia sua, quæ in lucem prodiderat, fructuum
 “ rudimenta, indeclinabili abortu dimissura. Palmi-
 “ colis itaque incumbit, ut impregnandis arboribus
 “ quotannis impendant operam, siquidem in se re-
 “ dundare annonam cupiunt. Modus procedendi
 “ hic

* Plinii Hist. Nat. lib. xiii. cap. iv.

† Alpin. de plant. Ægypt. p. 16.

§ Isagog. instit. rei herbar. p. 69.

|| Amœn. exot. p. 706.

** Dissert. de sexu plant. p. 29.

“ hie est : spaltæ masculæ incluso tumentes flore, et
 “ ad thalami consortium maturo, sub finem Februarii
 “ ex arboris fastigio extrahuntur ; quibus in longum
 “ dissectis eximuntur spadices, flosculis nondum of-
 “ citantibus, sed in unam massam compactis con-
 “ ferti. Hos protinus in furculos sive bacillos, spa-
 “ dicibus fæmininis inferendos divellunt. Bacillos
 “ alii amant recentes, atque illico insinuare spadici-
 “ bus, si qui jam lucem nacti sunt ; alii eos prius
 “ exsiccant, et in Martium usque mensem custodiunt,
 “ quo hiantibus uteris ad unum omnibus infitionem
 “ uno actu et opera instituant.”

As I am now upon the sex of plants, I cannot but observe, that although the ancients distinguished rightly, in determining the true sexes of the palm-tree, it is the only plant, in which they have not erred. Though they called plants of the same *genus*, or of others very nearly related thereto, male and female, it was upon an imaginary, a false principle ; and that usually taken from their size, the difference of their leaves, or the figure of their fruit ; and what therefore they have denominated male and female, must not with the modern exactness be rigorously considered as such. Thus Aristotle *, after having taken notice that there was the distinction of male and female observable in plants, says, “ that the male § plant
 “ is more rough and strong, the female more weak
 “ and fruitful.” And Theophrastus ||, when speak-
 ing

* De plant. lib. i. cap. 2.

ἐνείκεσαι ἐν τοῖς φυλοῖς δι' ἔχει τὰ φύλα γένος ἄρρεν καὶ θῆλυ.

§ Aristot. ibid.

|| Plantar. histor. lib. iii. cap. 10.

ing of the male and female pine-tree, says, " that
 " the Macedonians have trees nearly related to pines,
 " of which the male is of shorter growth, and has
 " harder leaves; that the female is taller, and has
 " its leaves softer, and more fleshy." He says, upon
 his own authority, " that the wood of the male pine
 " is hard, that of the female more soft." Pliny *
 also in his history gives a like reason for his distin-
 guishing the sex of the pine: he says farther §, in
 another part of the valuable monument he has left us,
 " that the most expert naturalists assert, that every
 " tree, and every herb, which the earth produces,
 " hath both sexes:" but this is to be understood in
 the manner I just now mentioned; and so likewise
 is the distinction among the more modern botanists
 in their denominations of several plants, such as *Ve-*
ronica, *Eupatorium*, *Anagallis*, *Tilia*, *Pæonia*, *Bal-*
samita, *Filix*, *Quercus*, *Orchis*, *Laureola*, *Abro-*
tanum, *Cornus*, *Polygonum*, *Equisetum*, *Mandragora*,
 and others, which are termed imaginarily male and
 female; as the discovery of the real sex of plants
 was reserved for the accuracy of the present age.

Besides the before-mention'd erroneous principle,
 from which the antients, as well as some more mo-
 dern authors, determined the sex of plants, there is
 yet another, which I think right to mention in this
 place; and that is, a denomination of plants from
 their sex, which is absolutely false: and in order to
 elucidate this position, and to shew at the same time
 wherein

* Lib. xvi. cap. 10.

§ Lib. xiii. cap. 4.

wherein the sex of plants does really consist, I must beg leave to premise, that it is in the flowers of vegetables only, that the parts subservient to generation are produced. Simple flowers (I use this term in opposition to the compound flowers of the botanists) are either male, female, or hermaphrodite. By male flowers, I would be understood to mean those, which are possessed only of those organs of generation, analogous to the male parts of animals; and these are, what former botanists have denominated *stamina* and *apices*, but are nam'd more properly by Linnæus since, *filamentum* and *anthera*. The female flower is only endowed with parts like those, which perform the office of generation in females; and these are the *pistillum* and its appertenances, which by Linnæus, with his accustomed accuracy, are divided into three parts; viz. the *germen*, *stylus*, and *stigma*. The hermaphrodite flower, which constitutes the great bulk of the vegetable creation, is possessed of all these parts in itself, and is itself thereby capable of propagating its species without any foreign assistance; which, by many incontestable experiments it has been found neither the male nor female flower simply is able to do.

Much the greater number of plants, as I have just hinted, have hermaphrodite flowers; but there are some, which have both the male and female flowers growing from the same root. Such are *Mays* or Indian corn, nettles, box, elm, birch, oak, walnut, beech, hazel, hornbeam, the plane-tree, pine, fir, cypress, cedar, the larch-tree, melons, cucumers, gourds, and several others. In many of these, though the male and female flowers are at considerable distances,

distances, the *farina fœcundans*, which Providence, on account of its being liable to be spoiled by rain, or dissipated by winds, has provided in great abundance, is conveyed to the female by means of the atmosphere. It is this class of vegetables, and the following, the quantity of the produce of which is much more precarious than those plants, which have hermaphrodite flowers; as the impregnation of these last may be performed within their own calyx; whereas the former must necessarily commit their *farina* to the circumambient air. It is for this reason, that if during the time of the flowering of these plants, the weather is either very wet or stormy, their produce of fruit will be very inconsiderable, from the spoiling or hasty dissipation of the male *farina*. Thus independent of frosts, the fruit of the nut and filbert-tree will be most numerous in those years, in which the months of January and February are the least stormy and wet; as at that time their flowers are produced. For the same reasons, a stormy or wet May destroys the chesnuts; and the same weather in July prodigiously lessens the crop of *Mays* or Indian corn, as its spikes of male flowers stand lofty, and at a considerable distance from the female. In like manner a judgment may be formed of the rest of these.

Some of the more skilful modern gardeners put in practice, with regard to melons and cucumers, the very method mention'd by Theophrastus 2000 years ago, in regard to the palm-tree. As these plants, early in the season, are in this climate confined to frames and glasses, the air, in which they grow, is more stagnant than the open air, whereby the distribution
of

of the *farina fœcundans*, so necessary towards the production of the fruit for the propagation of the species, is much hindered; to obviate which, they collect the male flowers when fully blown, and presenting them to the female ones, by a stroke of the finger they scatter the *farina fœcundans* therein, and this prevents the falling of the fruit immaturely.

Besides the vegetables before-mentioned, which bear both male and female flowers upon the same root, there are others, which produce those necessary organs upon different roots. In the number of these are the palm-tree (the more particular subject of this paper) hops, the willow-tree, mistletoe, spinach, hemp, poplar, French and dog's mercury, the yew-tree, juniper, and several others. Among these the *Valisneria* of Linnæus, as to the manner, in which its male flower impregnates the female, is one of the most singular prodigies in nature. The manner of this operation is figured by Micheli, in his *Nova plantarum genera*, and described by Linnæus, in the *Hortus Cliffortianus*. As that elaborate and expensive work is in very few hands, in such only as owe it to the munificence of Mr. Clifford of Amsterdam, of which number I with pleasure acknowledge myself one, I will here lay before you a short account thereof:

The *Valisneria* grows in rivulets, ditches, and ponds, in many parts of Europe. The male plant, which is continually covered with water, has a short stalk, upon the top of which its flowers are produced. As this top never reaches the surface of the water, the flowers are thrown off from it, and come unopened to the surface of the water; where, as

soon as they arrive, by the action of the air, they expand themselves, and swim round the female flowers, which are blown at the same time. These last have a long spiral foot-stalk, by which they attain the surface of the water, and remaining there in flower a few days, are impregnated by the male flowers detached from the stalk at the bottom. This operation seems to be thus directed, as the *farina fecundans* could not exert its effects in so dense a medium as water; and we find, that even the hermaphrodite flowers of water-plants, such as those of *potamogeton*, *ranunculus aquaticus*, *bottenia*, and *nymphæa*, these, I say, never expand themselves, until they reach the surface of the water.

But to return: it was not possible for me, without premising these things, to make evident what I just now mention'd, in relation to the falsely denominating the sexes of plants; as it is to this last class that the wrong application has been made by botanical writers. This error seems to have been first introduced so early as by Dioscorides, and has been continued through a great variety of writers even to our own time. It is most certain, that those plants, which produce the seed, ought to be considered as females; but it happens that in the French and dog's mercury, the seeds are produced in the female plants by pairs; and these are contained in a capsule, which was thought to resemble the *scrotum* of animals; and from this testiculated appearance they called these plants males, and the others females.

Thus, for example, Dioscorides*, when treating of *mercurialis*, or what we here call French mercury, says, that “ the seed of the female is produced in bunches, and is copious; that of the male grows near the leaves; that it is small and round, and is disposed in pairs like testicles.” Dodonæus, Lobel, Dalechamp, John and Caspar Bauhin, Morrifon, Tournefort, and Boerhaave, in their several works, have in this followed Dioscorides, and have denominated the seed-bearing plant of this kind, the male; and the other, the female. Fuchsius and John Bauhin likewise call the *cynocrambe* or dog’s mercury, which bears fruit, the male; and the spiked one with male flowers only, the female. This mistake is observable in hemp §, hops, and spinach.

We observe, that the operations of nature are carried on most usually by certain general laws, from which however she sometimes deviates. Thus almost all plants have either hermaphrodite flowers, or male and female flowers growing from the same root, or male and female flowers from different roots: but there are a few of another class, which from the same root furnish either male and hermaphrodite flowers, or female and hermaphrodite flowers. Of this kind are the mulberry-tree, the *musā* or plantain-tree, white hellebore, pellitory, arrach, the ash-tree, and a few others. But of this class the *empetrum*

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or

* Dioscorid. lib. iv. cap. 9. edit. Saracen.

Λινόζωσις οἱ δὲ παρθένιον, οἱ δὲ Ἑρμῆς ἐοικένιον καλεῖται . . . τὸν δὲ καρπὸν ἢ μὲν θήλεια βόλβουσιδ’ ἢ καὶ πολύν· ὃ δὲ ἄρρην πρὸς τοῖς πείλαις μικρὸν, στρογγύλον, ὥσπερ ὄρχιδ’ αἰα καὶ δύο περισκείμενα . . .

§ Matthiol. in Dioscorid. p. 663. semen tantum in mari gignitur:

or berry-bearing heath is the most extraordinary ; as of this are found some plants with male flowers only. others with both male and female flowers separately, and still others with hermaphrodite flowers.

What Pere Labat mentions in his *Voyage à l'Afrique occidentale* should likewise be taken notice of here. This author, after having laid down the different methods of impregnating the female palm-tree by the male, says, that this process is not absolutely necessary for the production of dates ; for being at Martinico, he there saw growing by an old convent near the place, where they anchored, a palm-tree bearing dates, although the only one of its kind, which was thereabouts. Whether it was male or female, he did not pretend to determine, but was certain, that there then was none, nor had been one, within two leagues of the place where it grew. He doubts indeed, whether or no this tree bearing fruit did not proceed from the *farina fecundans* of the male cocoa tree, which is a species of palm, and which grew in abundance near the tree that bore dates : but he observes, that the stones of these dates did not vegetate, and that those, who were desirous of propagating date-trees, were obliged to plant the Barbary dates ; as he believed the others had not the germ proper to produce the tree. From this account it is very obvious, that the palm-tree here mentioned was a female, in which though the fruit ripened, it was in such a state of imperfection, as not to be able to propagate its species. In this manner we have eggs furnished us by hens, even without a cock ; but these eggs produce no chickens. What this father says of the female palm-tree's bearing fruit
without

without the assistance of the male, our very ingenious and worthy brother Mr. Miller assures me, has been fully confirmed to him by several persons : and John Bauhin*, an author of great credit, describes and figures the whole fructification of a palm-tree, which himself saw growing at Montpellier, and which not only produced branches of male flowers, but also female ones bearing dates. Mr. Ray many years after tells us in his history of plants §, that he himself at Montpellier saw this very remarkable tree mentioned by John Bauhin.

This variety in the fructification of the palm-tree, singular as it may seem, has been likewise observed in some few others. The learned Jungius, in his *Doxoscopia* ||, mentioning that class of trees, which are male and female in different parts of the same tree, says, “ that trees of this kind, when they “ have for many years produced flowers without “ fruit, afterwards produce fruit without flowers. “ This, he thinks, should be further inquired into.” This, since Jungius’s time, has been done, and it has been found that sometimes some of the trees of this class are wholly male, while young ; but as they advance in age, they have flowers of both sexes, and afterwards become intirely female. This fact Mr. Miller has frequently himself observed in the mulberry tree ; and the Chevalier Rathgeb, at present the emperor’s minister at Venice,

* H-A plant. rom. i. p. 351.

§ Ray. hist. plant. rom. ii. p. 1354.

|| Ray. p. 145. *Uni al quo annos flores tulerunt sine fructu, deinceps fructus ferre sine flore, quod amplius observandum.*

nice, a gentleman excellently well versed in whatever relates to vegetation, has observed, that a large *lentiscus*, or mastich-tree, near his garden, had for thirty years produced only male flowers, but that for three years past it had produced plenty of fruit.

The foundation of the discovery of the real sex of plants, which is of no less importance in natural history, than that of the circulation of the blood in the animal œconomy, was laid by the members of this learned Society; although much of the honour due to them is attributed by foreigners to the late ingenious Monsieur Vaillant of Paris: and this may have arisen from our language not being generally understood upon the continent. Sir Thomas Millington *, sometime Sedleian lecturer of natural philosophy at Oxford, as we see by our worthy member Dr. Grew's anatomy of plants §, seems first to have assigned a more noble purpose to the *stamina* and *apices* of flowers, than that which had been attributed thereto by preceding writers, and by Monsieur Tournefort afterwards; viz. that of secreting some excrementitious juices, which were supposed hurtful to the embryo's of the fruit. Sir Thomas conjectured, and rightly, " that the *stamina* " and *apices* served as the male for the generation " of seed." This hint, which was afterwards adopted by our learned brother Mr. Ray, in the preface to

* Dr. Grew calls Sir Thomas Millington Savilian professor, which is a mistake. See *Wood's Fasti. Oxon.* vol. ii. col. 126. 2d edit.

to his *Sylloge stirpium exterarum*, Dr. Grew carried farther, as we find by his works; and it was followed by || Rodolphus Jacobus Camerarius, professor at Tubingen: but our very industrious and sagacious member Mr. Morland * pursued long after this inquiry still much higher, as we see by his excellent memoir published in the *Philosophical Transactions*, to which I must beg leave to refer you. After these, Messieurs Vaillant and Geoffroy illustrated and strengthened these discoveries by very curious and well adapted experiments; so that at present nothing seems wanting for the confirmation of the truth of this doctrine.

So much for the discovery of the sex of plants in general, upon which professor Linnæus of Upsal has founded his system of botany, at present so much and so well received. Whoever therefore would consider minutely the structure of flowers and the almost infinite variety of the number and disposition of their parts, may consult Linnæus's *Philosophia botanica* lately published, where this subject is treated in a very copious and instructive manner.

|| Vide epistol. de sexu plant. Tubing 1694.

* Philosoph. Transf. numb. 287.